

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

**TRIMESTER 2, 2016/2017**

**TCS 2241 – COMPUTATIONAL SCIENCE**

( All sections / Groups )

7 MARCH 2017  
2.30 p.m – 4.30 p.m  
(2 Hours)

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### INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 5 pages (excluding cover page) with 5 Questions.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided

**Question 1**

(a) A financial advisor at Dell Investment identified two companies that are likely candidates for a takeover in the near future. Eastern Cable is a leading manufacturer of flexible cable systems used in the construction industry and ComSwitch is a new firm specializing in digital switching systems. Eastern Cable is currently trading for RM40 per share and ComSwitch is currently trading for RM25 per share. If the takeovers occur, the financial advisor estimates that the price of Eastern Cable will go to RM55 per share and ComSwitch will go to RM43 per share. At this point in time, the financial advisor identified ComSwitch as the higher risk alternative. Assume that a client who indicated a willingness to invest a maximum of RM50,000 in the two companies wants to invest at least RM15,000 in Eastern Cable and at least RM10,000 in ComSwitch. Because of higher risk associated with ComSwitch, the financial advisor recommends that at most RM25,000 should be invested in ComSwitch.

Formulate a Linear Programming model that can be used to determine the number of shares of Eastern Cable and the number of shares of ComSwitch that will meet the investment constraints and maximize the total return for the investment.

[3.5 marks]

(b) Given an initial simplex table for a Linear Programming problem:

Basic Variable	Coefficient of								Solution
	Z	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	A <sub>1</sub>	
Z	1	-7	6	-6	0	0	0	-M	0
S <sub>1</sub>	0	1	0	1	1	0	0	0	6
S <sub>2</sub>	0	1	-1	1	0	1	0	0	5
A <sub>1</sub>	0	1	1	2	0	0	-1	1	1

(i) Refer to the initial table, formulate the objective function and constraints in standard equation form for a maximization problem. [2.5 marks]

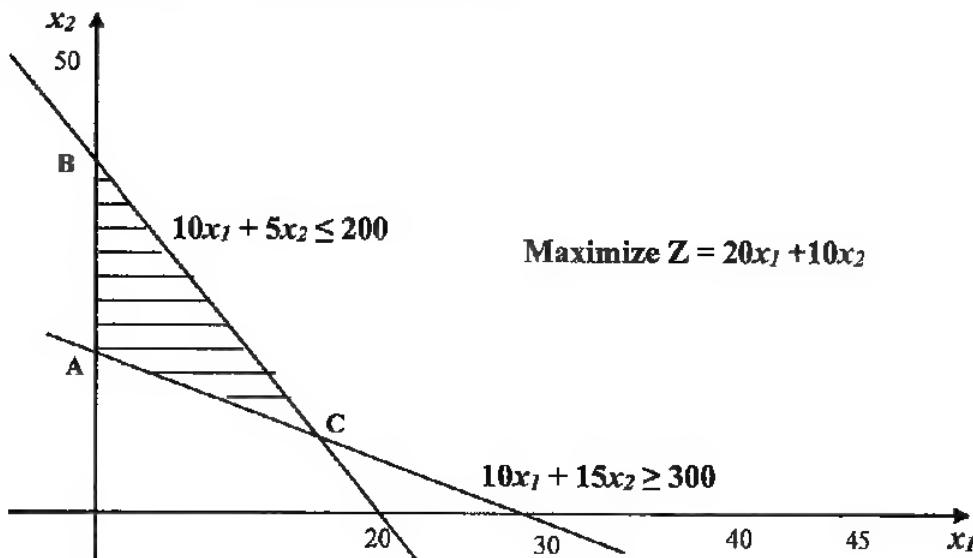
(ii) Simplex rule has been violated, where one of the basic variables has a non-zero value in Z-row. To correct this violation, prepare a new initial table. [2 marks]

(iii) Identify the entering and leaving variables from the new initial table. [2 marks]

Continued...

**Question 2**

(a) Consider the following Linear Programming problem with the shaded feasible region represented in graphical method.



(i) How do you relate the corner points and objective function of graphical method with algebraic solution? [2 marks]

(ii) Find out the corner points A, B and C. [2 marks]

(iii) One of the special cases in Linear Programming has occurred in the feasible solution for the above problem. How did the special case affect the optimal solution? [2 marks]

(b) Piko and Psy are students from FIST. They are requested to solve the following Linear Programming problem.

$$\text{Max } z = 15x_1 + 17x_2 + 3x_3 - 14x_4 + 8x_5$$

Subject to

$$12x_1 + 5x_2 + 14x_3 + 7x_4 + 8x_5 \leq 45$$

$$12x_1 - 12x_2 + 6x_3 + 9x_4 + 18x_5 \geq 5$$

$$10x_1 + 5x_2 + 8x_3 + 12x_4 + 12x_5 \leq 20$$

$$x_1, x_2, x_3, x_4, x_5 \geq 0$$

(i) Piko has decided to choose simplex method, instead of graphical and algebraic methods. Why? Explain. [2 marks]

(ii) If Psy has decided to use algebraic method, how many basic solutions will he get? Show the steps. [2 marks]

**Continued...**

**Question 3**

(a) Table below shows the quantity of supply and demand for two sources and three destinations, associated with their respective transportation cost.

	<b>D1</b>	<b>D2</b>	<b>D3</b>	<b>Supply</b>
<b>S1</b>	15	30	20	50
<b>S2</b>	30	40	35	30
<b>Demand</b>	25	45	10	

(i) Use Northwest-corner method to find the initial cost. [2 marks]

(ii) The following table shows a particular iteration from the optimality test of the transportation cost, where non-basic variables are indicated with (.)

	<b>v<sub>1</sub>=15</b>	<b>v<sub>2</sub>=30</b>		<b>v<sub>2</sub>=20</b>		
<b>u<sub>1</sub>=0</b>		15		30		50
	25		15		10	
<b>u<sub>2</sub>=10</b>		30		40		30
		(-5)	30		(-5)	
	25		45		10	

How do you check the optimality of this iteration? If it is not optimal, continue to the next iteration? If it is optimal, compare the cost with (i).

[3 marks]

(b) Hi-Earn financial consulting firm has four project leaders available for assignment to three clients. Find the assignment of project leaders to clients that will minimize the total time.

<b>Project leader</b>	<b>Client (times in days)</b>		
	<b>1</b>	<b>2</b>	<b>3</b>
<b>Terry</b>	10	15	9
<b>James</b>	9	18	5
<b>Lynn</b>	6	14	3
<b>John</b>	8	16	6

[5 marks]

Continued...

**Question 4**

(a) Yuna is doing her Final Year Project in this trimester. She has identified several activities, time requirements (weeks) and immediate predecessors of the activities are given in the table below.

Activity	Immediate Predecessors	Optimistic	Most Likely	Pessimistic
A	-	1	3	5
B	-	7	10	13
C	-	5	7	9
D	A	3	5	7
E	D	2	4	6
F	B, E	3	6	9
G	B, C, E	5	9	13
H	F	5	4	12
I	G	3	5	7
J	H, I	3	6	9

(i) Illustrate the project network diagram. [3 marks]

(ii) Determine the earliest and latest event times for each of the activities. [3 marks]

(b) Consider the following final iteration matrices,  $D_s$  and  $S_s$  from Floyd's algorithm.

		<b><math>D_s</math></b>				
		1	2	3	4	5
1	-	30	40	45	77	
2	30	-	50	15	47	
3	40	50	-	35	67	
4	45	15	35	-	32	
5	77	47	67	32	-	

		<b><math>S_s</math></b>				
		1	2	3	4	5
1	-	2	3	2	4	
2	1	-	4	4	4	
3	1	4	-	4	4	
4	2	2	3	-	5	
5	4	4	4	4	-	

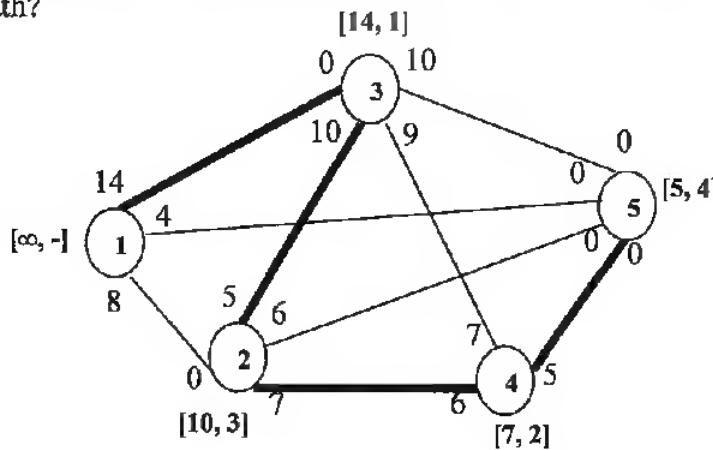
(i) Determine the shortest route from node 5 to node 1? [1 mark]

(ii) Which pair of nodes contributes the shortest distance among all nodes? [1 mark]

**Continued...**

(c) Given the first iteration of the maximal flow model from source node 1 to sink node 5. Explain how do you compute the maximum flow,  $f_1$  along the highlighted flow path?

[2 marks]



### Question 5

(a) G-Vision Inc. has estimated that the new technology - pico projector will revolutionize the mobile phone industries in next few years. They had estimated that the annual demand for pico projectors is 50,000. The setup cost for an order is RM 200. The company estimated that the cost of carrying a unit of pico projector in the stock for a year is RM 1.50. Assume that the demand is constant throughout the year. You were assigned to purchase it.

(i) How many pico projectors should you order at a time to minimize the total inventory cost?

[1 mark]

(ii) If only **FOUR (4)** orders were placed each year in the new policy, compare the total cost with old policy in (i)?

[3 marks]

(b) Solve the following non-linear programming problem by using the **Lagrangian method**.

$$\text{Minimize } Z = x^3 + 2y^2$$

Subject to the constraints

$$0.5x + y = 8$$

$$x, y \geq 0$$

[6 marks]

**End of Paper**